MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2017/2018

TMT1111 – NUMERICAL MATHEMATICS

(All sections / Groups)

30 May 2018
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This Question paper consists of **3 pages** only excluding the cover page with **5 Questions** and an **Appendix**.
2. Attempt **ALL FIVE (5)** questions.
3. Please write your answers in the Answer Booklet provided, and **start each question on a new page.**
4. Show all steps.
5. Formulas are provided and attached in Appendix.

Answer ALL FIVE (5) questions.

Question 1 [10 marks]

a. The measure of length of a computer table for the instructor in Database lab is 98 *cm*. If the length of this table is 100*cm*, compute

i. the absolute error. **[2 marks]**
ii. the relative error. **[2 marks]**
iii. the percent relative error. **[2 marks]**

b. Consider the number: 231.9878.
i. Determine the significant digits, *d*, of the number. **[1 mark]**
ii. Determine the decimal places of accuracy, *t*, of the number. **[1 mark]**
iii. Round the number to 2 decimal places. **[1 mark]**
iv. Chop the number to 2 decimal places. **[1 mark]**

Question 2 [10 marks]

Perform the first TWO iterations for $f(x) = 2x^2 + x$ based on the following methods. Write down the equation for each method.

a. Simple iterative method starting with $x_0 = 1$. **[5 marks]**
b. Newton-Raphson Method starting with $x_0 = 1$. **[5 marks]**

Question 3 [10 marks]

Consider the following system of linear equations:

$$x - 2y - 5z = 1$$
$$4x - 2y - z = 2$$
$$-x + 5y - z = 3$$

a. Represent the system above in the matrix notation. **[1 mark]**
b. Write the system above in the augmented matrix. **[1 mark]**
c. Determine whether the system above needs to be rearranged into the form of a diagonally dominant system if it is to be solved by using **Gauss-Seidel Iteration method.** Then, solve the system using **Gauss-Seidel Iteration method** by performing the first TWO iterations if $x_0 = 0, y_0 = 0$ and $z_0 = 0$.
(**Note**: Round all the numbers to four decimal places.)
[8 marks]

Continued.....

Question 4 [10 marks]

a. Compute the difference table for the following set of data points and fill your answers in the following table.

x	$f(x)$	Δ	Δ^2
2.35	0.85442		
2.36	0.85866		
2.37	0.86289		
2.38	0.86710		
2.39	0.87129		

[3.5 marks]

b. Use Newton's Forward difference formula to pass a polynomial degree 2 through the above data. **[2 marks]**

c. Use the polynomial of part (b) to interpolate $f(2.352)$. **[4.5 marks]**

Question 5 [10 marks]

a. Complete the following table for $f(x) = \dfrac{(x^2-1)}{(x^3+2x+1)}$.

x	0	0.2	0.4	0.6	0.8	1.0
$f(x)$						

[3 marks]

b. Using the table of part (a) above, compute the integration $\int_0^1 \dfrac{(x^2-1)}{(x^3+2x+1)}dx$ based on the following rules. Take $h = 0.2$.

i. Trapezoidal rule. **[2 marks]**
ii. Simpson's 1/3th rule. **[2.5 marks]**
iii. Simpson's 3/8th rule. **[2.5 marks]**

(**Note**: Round all the numbers to four decimal places.)

Continued.....

Appendix

TABLE OF FORMULAE

Newton's Raphson Method

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$$

Newton's forward-difference interpolation formula

$$f_p(x) = f(x_0) + p\Delta f_0 + \frac{p(p-1)}{2}\Delta^2 f_0 + \frac{p(p-1)(p-2)}{3!}\Delta^3 f_0 + \frac{p(p-1)(p-2)(p-3)}{4!}\Delta^4 f_0 + \ldots + \frac{p(p-1)(p-2)\ldots(p-n+1)}{n!}\Delta^n f_0$$

Trapezoidal rule

$$I_T = \frac{h}{2}[f_0 + f_n + 2(f_1 + f_2 + f_3 + \ldots f_{n-1})]$$

Simpson's 1/3rd rule

$$I_S = \frac{h}{3}[(f_0 + f_n) + 4(f_1 + f_3 + f_5 + \ldots + f_{n-1}) + 2(f_2 + f_4 + f_6 + \ldots + f_{n-2})]$$

Simpson's 3/8th rule

$$I_{SR} = \frac{3h}{8}\{f_0 + 3(f_1 + f_2) + 2f_3 + 3(f_4 + f_5) + 2f_6 + \ldots + 3(f_{n-2} + f_{n+1}) + f_n\}$$

End of Paper